MICOM® Micro4000 DataModem

User's Manual

Models M4096/V.29 + and M4296/V.29 +

800-1153-2b

Electronic Services - Los Angeles
M14014X

Micro4000
Data Modem

Models M4096/V.29 +
and M4296/V.29 +

User's Manual

Stock Number 800-1153-2b

WARNING:

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

If radio frequency interference is encountered after installation of the equipment, necessary corrective measures are required to reduce this interference. Information about recommendations for such measures can be obtained from the manufacturer. Contact MICOM Corporate Headquarters for assistance.

April 1986

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INTRODUCTION

HOW TO USE THIS MANUAL

This User's Manual, just like your Model M4096/V.29+ Data Modem and your Model M4296/V.29+ Data Modem, is designed to be easy to use:

Section 1 Do-It-Yourself Installation, contains a "bare-bones" procedure for installing your modem.

Section 2 Testing Your Modem, contains information to aid you in detecting and isolating faults.

Appendixes contain details on a variety of topics which are included to help you solve your technical problems.

A *Subject Index* is provided.

INTRODUCING THE Micro4000 MODELS M4096/V.29+ AND M4296/V.29+

This unit is a high-speed data modem, designed for use with synchronous terminal equipment at 9600, 7200, or 4800 bps. It is suitable for point-to-point and multipoint applications at 9600, 7200, or 4800 bps.

The Data Modem provides *automatic compensation* for a wide variety of telephone line problems and distortions, and eliminates the need for line conditioning. It is designed for use with AT&T Type 3002 basic, unconditioned channels. It offers significant cost savings when compared with other high-speed modems.

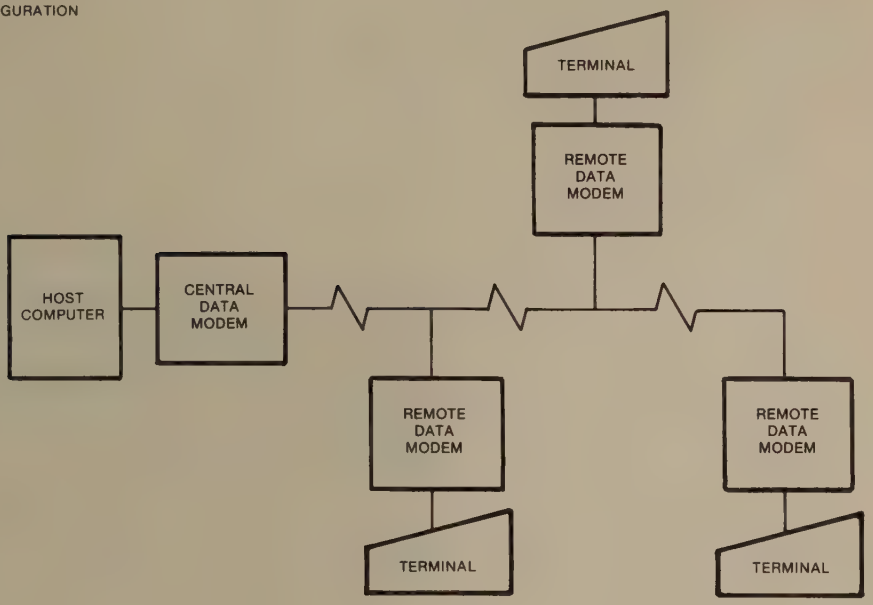
These units conform to the Consultative Committee for Telegraphy and Telephony (CCITT) recommendations V.29 and V.27 bis, which detail the 9600 and 4800 bps modems that are standardized for use on leased circuits, respectively.

The M4296/V.29+ is a card module designed to be used in a Model M4200 rack-mount chassis. It is functionally and electrically identical to the M4096/V.29+.

APPLICATIONS

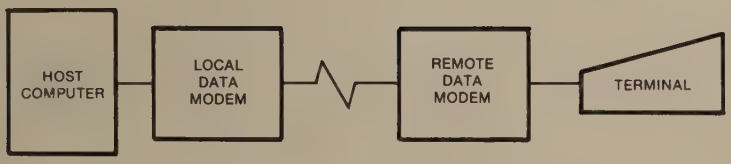
The illustrations below depict typical applications of the data modem. The multipoint application requires terminals capable of being polled.

MULTIPOINT CONFIGURATION



MI-4096-02

POINT-TO-POINT CONFIGURATION



MI-4096-01

Figure Intro-1. Typical Applications

SECTION 1

DO-IT-YOURSELF INSTALLATION

UNPACKING AND INSPECTING FOR DAMAGE

Your unit is packed completely assembled, ready for use.

Inside the box, you should find (check the Packing List):

- Your M4096/V.29+ or M4296/V.29+ unit
- This manual
- A power supply assembly

Your Unit Should Arrive in Good Condition

- MICOM *thoroughly inspected* and *carefully packed* your unit.
- The CARRIER accepted responsibility for its safe delivery.

In Case of Damage

- Note visible damages *directly* on the freight bill and have the CARRIER *acknowledge* them.
- Report concealed damage to the CARRIER — *immediately upon discovery.*
- Submit damage claims to the CARRIER, *not to MICOM.*

INSTALLATION PROCEDURE

The Installation Procedure gives you the required steps for Do-it-Yourself Installation. The procedure will take you from the selecting of a location for your unit to the start-up of the unit. Page references in each step direct you to detailed descriptions for that function.

Standalone Unit

1. Select a location site for your unit. (page 1-4)
2. Open your unit. (page 1-5)
3. Determine operational modes that you require for your equipment. (page 1-6)
4. Locate switch groups on modem. (page 1-9)
5. Set switches to your configuration needs. (pages 1-10 through 1-12)
6. Connect terminal cable. (page 1-16)
7. Attach communications (telephone) line. (page 1-17)
8. Connect power supply to unit. (page 1-18)
9. Close your unit.
10. Plug power cord into grounded outlet. (page 1-18)
11. Observe LED display on front panel. Interpret display according to your configuration:

Four-Wire Point-to-Point	(page 1-19)
Four-Wire Multipoint	(page 1-20)
Two-Wire	(page 1-21)

Rack-Mount Card Module

1. Open hinged front panel of the rack-mount chassis (Model M4200). (page 1-5)
2. Slide card module out. (page 1-5)
3. Determine operational modes that you require for your equipment. (page 1-6)
4. Locate switch groups on card module. (page 1-9)
5. Set switches to your configuration needs. (pages 1-10 through 1-12)
6. Once the M4200 has been connected to the terminal cable and to telephone lines, the card modules may be inserted and removed without removing those cables or powering down the rack-mount chassis.
7. Power supplies are in rack-mount chassis.
8. Slide card module into rack-mount, making sure it is secured into connectors on back-plane of the chassis.
9. Close hinged front panel.
10. Observe LED display on front panel. Interpret display according to your configuration:

    Four-Wire Point-to-Point (page 1-19)
    Four-Wire Multipoint (page 1-20)
    Two-Wire (page 1-21)

SELECTING A LOCATION FOR YOUR UNIT

Your unit should be located near the equipment (computer or terminals) with which it connects so that your interface cables will reach. Your unit should also be located within six feet of a grounded ac outlet so that your ac power cord will reach.

CAUTION

Do not stack other equipment on top of the standalone unit.

Provide sufficient space for cover removal, switch access, and unobstructed air flow around your unit. To aid you in planning for space requirements, the dimensions of units are listed below.

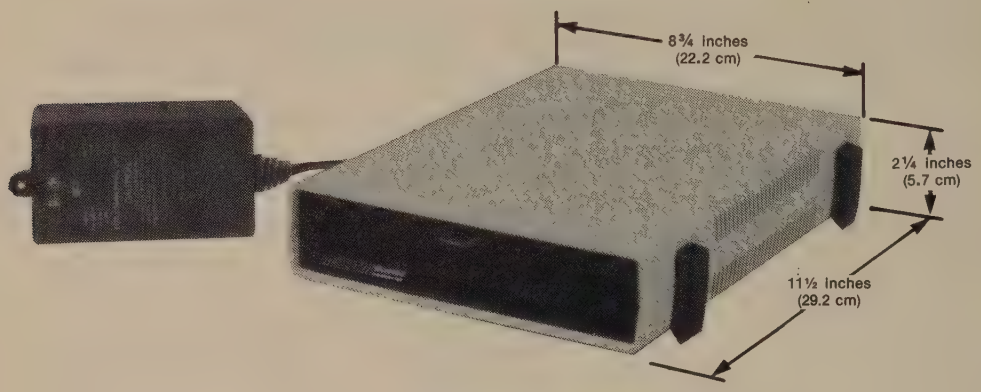


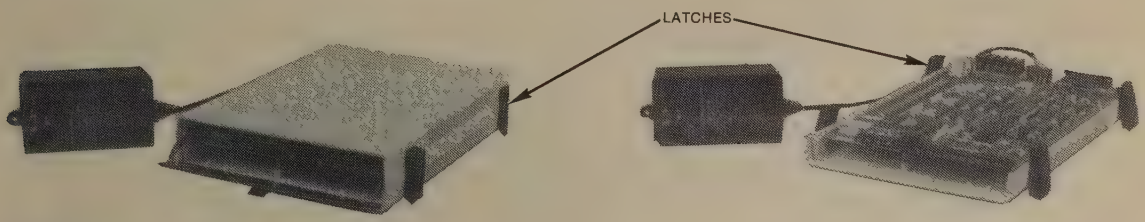
Figure 1-1. Dimensions

ACCESSING THE SWITCHES OF YOUR UNIT

To perform the next steps in do-it-yourself installation, you must open your Data Modem to gain access to switches located inside (see figure 1-2).

For Standalone Units

Remove the top cover of your M4096/V.29+ by unfastening four latches (two on each side of the unit) — pull bottoms of latches away from unit to release. A hinged front panel allows access to test switches when unit is closed.



MP-4096-02.1c MP-4096-03.1c

Figure 1-2. Access to Switches

For Card Modules

Pull down the front panel of the Model M4200 rack-mount chassis. Using the ejector, slide the M4296/V.29+ module out. This is a 9600 bps V.29 compatible module designed to be used in an M4200 chassis. Up to eight M4296/V.29+ card modules may be housed in one M4200.

CONFIGURING YOUR UNIT

Operational Modes

The Data Modem has seven modes of operation available. These modes are selected via switch groups S5, S6, S7, and S8 (see figure 1-3). In order to determine which of the seven modes is appropriate for your installation, you will need to provide answers to the following questions:

1. Does your system operate point-to-point? If so, refer to Point-to-Point Operation.
2. Does your system operate in multipoint? If so, refer to Multipoint Operation.
3. Does your system operate two-wire, half-duplex? If so, refer to Two-Wire, Half-Duplex Operation.

NOTE

Figure 1-3 and tables 1-1 through 1-4 follow the description of operation modes.

Point-to-Point Operation

The Data Modem has three options available for point-to-point operation.

Option A:

Normal mode is 9600 bps V.29, and fallback mode is 7200 bps V.29. See tables 1-1 through 1-4 for configuring both modems to Mode 1.

Option B:

Normal mode is 9600 bps V.29, and fallback mode is 4800 bps V.29. See tables 1-1 through 1-4 for configuring both modems to Mode 2.

Option C:

Normal mode is 7200 bps V.29, and fallback mode is 4800 bps V.29. See tables 1-1 through 1-4 for configuring both modems to Mode 3.

Multipoint Operation

The Data Modem has three options available for a multipoint operation.

Option A:

You would use this option if you use interactive short messages inbound and long messages outbound in your operation. The rate for data outbound is 9600 bps, and data inbound is 4800 bps. The training time inbound is 9 ms.

Data transmission inbound is 2400 bps for 26 ms, after which the data rate increases to 4800 bps inbound. Use Mode 7 at the central modem and remote modems. Fallback rate for this configuration is 4800 bps V.29 outbound, 4800 bps speedshift inbound.

See table 1-1 for configuring the central modem to Mode 7. See tables 1-2 through 1-4 for configuring the remote modems to Mode 7.

Option B:

If you require 9600 bps inbound and outbound in your operation, then set both the central and remote units for Mode 5. Inbound training time is 75 ms; fallback is 7200 bps inbound and outbound.

See table 1-1 for configuring the central modem to Mode 5. See tables 1-2 through 1-4 for configuring the remote modems to Mode 5.

Option C:

If you require 9600 bps inbound and outbound in your operation, and your remote units cover great distances (e.g. cross country), then it is advisable to use Mode 4 to ensure system integrity. Training time is 100 ms; fallback is 7200 bps. If a fallback of 4800 bps V.27 bis is desired, use Mode 6.

See table 1-1 for configuring the central modem to Mode 4 or Mode 6. See tables 1-2 through 1-4 for configuring the remote modems to Mode 4 or Mode 6.

Two-Wire, Half-Duplex Operation

Two options are available for your Data Modem if one of the following conditions apply: 1) if your unit is a part of a dial-up phone system with appropriate connecting devices; 2) if you are using two-wire leased lines.

Option A:

A data rate of 9600 bps with 100 ms training time will use Mode 1. The fallback rate is 7200 bps with 100 ms training.

See table 1-2 for configuring both modems to Mode 1.

Option B:

A data rate of 7200 bps with 100 ms training will use Mode 3. The fallback rate is 4800 bps with a V.27 bis training sequence.

See table 1-2 for configuring both modems to Mode 3.

Diagnostic Address (Multipoint)

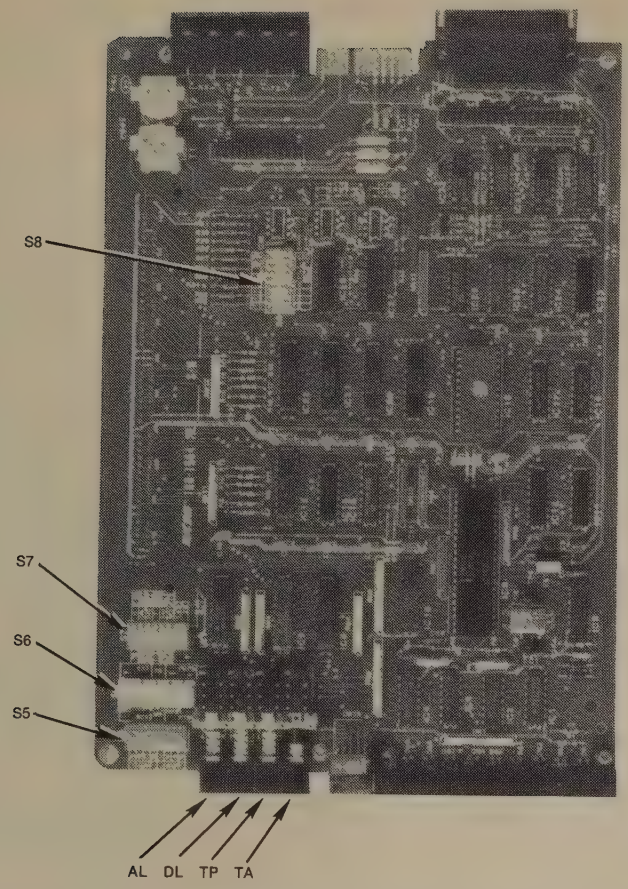
Your unit is equipped with both global and discrete diagnostic addressing. This requires that you select the address for the location of each modem before installing them. It is recommended that a record be made for each assigned modem address, identifying the site and personnel to contact (see tables 1-3 and 1-4).

Modems may be addressed in any order, with the following three constraints:

1. Only remote multipoint modems are addressable.
2. No two remote multipoint modems may have the same address.
3. Remote multipoint modems must be addressed in the range of 0-F (hex).

Diagnostic Address (Point-to-Point)

In point-to-point operation, there is no need to configure switches since the modems do not require addresses.



MP-4096-04.2

Figure 1-3. Configuration Switch Group Locations

Table 1-1. Switch Settings for Local Modems

These settings are for both modems in 4-wire point-to-point or for the central modem in a multipoint operation.

NOTE

On switch groups, the CLOSED position is equivalent to ON; OPEN is equivalent to OFF.

Position			Mode						
Switch Group S5			1	2	3	4	5	6	7
	1	A	OFF	ON	OFF	ON	OFF	ON	OFF
CONF	2	B	OFF	OFF	ON	ON	OFF	OFF	ON
(data pump	3	C	OFF	OFF	OFF	OFF	ON	ON	ON
configuration)	4	D (Fallback)	OFF	OFF	OFF	OFF	OFF	OFF	OFF
ADDR	5	1	See table 1-3 for diagnostic address settings						
(modem	6	2							
addresses)	7	4							
	8	8							
Switch Group S6			(For switch group S6, the ON setting is toward the back of modem card; OFF is toward the front of modem card.)						
1			OFF	OFF	OFF	OFF	OFF	OFF	OFF
2			OFF	OFF	OFF	OFF	OFF	OFF	OFF
3			OFF	OFF	OFF	OFF	OFF	OFF	OFF
4			ON	ON	ON	ON	ON	ON	ON
5			ON	ON	ON	ON	ON	ON	ON
Switch Group S7									
1			OFF	OFF	OFF	OFF	OFF	OFF	OFF
2			OFF	OFF	OFF	OFF	OFF	OFF	OFF
3			OFF	OFF	OFF	OFF	OFF	OFF	OFF
4			OFF	OFF	OFF	OFF	OFF	OFF	OFF
5			OFF	OFF	OFF	ON	ON	ON	ON
6			ON	ON	ON	ON	ON	ON	ON
7			ON	ON	ON	ON	ON	ON	ON
8			OFF	OFF	OFF	OFF	OFF	OFF	OFF
Switch Group S8									
1			OFF	OFF	OFF	OFF	OFF	OFF	OFF
2			OFF	OFF	OFF	OFF	OFF	OFF	OFF
3			OFF	OFF	OFF	OFF	OFF	OFF	OFF
4			OFF	OFF	OFF	OFF	OFF	OFF	OFF
5			ON	ON	ON	ON	ON	ON	ON
6			OFF	OFF	OFF	OFF	OFF	OFF	OFF
7			ON	ON	ON	ON	ON	ON	ON
8			ON	ON	ON	ON	ON	ON	ON

Table 1-2. Switch Settings for Remote Modems

These settings are for remote modems in multipoint and for both modems in the 2-wire mode.

NOTE

On switch groups, the CLOSED position is equivalent to ON; OPEN is equivalent to OFF.

Position			Mode						
Switch Group S5			1	2	3	4	5	6	7
	1	A	OFF	(NOT	OFF	ON	OFF	ON	OFF
CONF	2	B	OFF	USED)	ON	ON	OFF	OFF	ON
(data pump	3	C	OFF		OFF	OFF	ON	ON	ON
configuration)	4	D (Fallback)	OFF		OFF	OFF	OFF	OFF	OFF
	5	1							
ADDR	6	2	See table 1-3 for diagnostic address						
(modem	7	4	settings						
addresses)	8	8							
Switch Group S6			(For switch group S6, the ON setting is toward the back of modem card; OFF is toward the front of modem card.)						
1			OFF	(NOT	OFF	ON	ON	ON	ON
2			OFF	USED)	OFF	OFF	OFF	OFF	OFF
3			OFF		OFF	OFF	OFF	OFF	OFF
4			ON		ON	ON	ON	ON	ON
5			ON		ON	ON	ON	ON	ON
Switch Group S7									
1			OFF	(NOT	OFF	OFF	OFF	OFF	OFF
2			ON	USED)	ON	ON	ON	ON	ON
3			OFF		OFF	OFF	OFF	OFF	OFF
4			OFF		OFF	OFF	OFF	OFF	OFF
5			ON		ON	OFF	OFF	OFF	OFF
6			ON		ON	OFF	OFF	OFF	OFF
7			OFF		OFF	ON	ON	ON	ON
8			ON		ON	OFF	OFF	OFF	OFF
Switch Group S8									
1			OFF	(NOT	OFF	OFF	OFF	OFF	OFF
2			OFF	USED)	OFF	OFF	OFF	OFF	OFF
3			OFF		OFF	OFF	OFF	OFF	OFF
4			OFF		OFF	OFF	OFF	OFF	OFF
5			ON		ON	ON	ON	ON	ON
6			OFF		OFF	OFF	OFF	OFF	OFF
7			ON		ON	ON	ON	ON	ON
8			ON		ON	ON	ON	ON	ON

Table 1-3. Modem Diagnostic Addresses

NOTE

On switch groups, the CLOSED position is equivalent to ON; OPEN is equivalent to OFF.

Modem Address (hex)	Switch Group S5 — ADDR				
	*1	2	4	8	(binary value)
0	OFF	OFF	OFF	OFF	
1	ON	OFF	OFF	OFF	
2	OFF	ON	OFF	OFF	
3	ON	ON	OFF	OFF	
4	OFF	OFF	ON	OFF	
5	ON	OFF	ON	OFF	
6	OFF	ON	ON	OFF	
7	ON	ON	ON	OFF	
8	OFF	OFF	OFF	ON	
9	ON	OFF	OFF	ON	
A	OFF	ON	OFF	ON	
B	ON	ON	OFF	ON	
C	OFF	OFF	ON	ON	
D	ON	OFF	ON	ON	
E	OFF	ON	ON	ON	
F	ON	ON	ON	ON	

*These numerical values correspond to positions 5 through 8 on Switch Group S5.

Table 1-4. Modem Address Record

NOTE

Record forms for your modem address assignments are provided in appendix D.

Modem Address (hex)	Field Definition
0	Name Address City State Tel. No. Person to Contact
1	Name Address City State Tel. No. Person to Contact

Addresses 2 through E (hex)

F	Name Address City State Tel. No. Person to Contact

CONFIGURATION FUNCTIONS

You may select the configuration functions through switch settings on switch groups S6, S7, and S8. Switch group S5 controls the modem data speeds and sets modem addresses for the operation modes that you have selected. You must set switch group S5 according to the settings listed in tables 1-1 through 1-3.

Transmit Clock (Switch Group S6, Positions 1 and 2)

The transmit clock source has three switch selectable settings: INT, EXT, and RCV.

- If you select INT (positions 1 and 2 OFF), the modem transmit clock is free running.
- If you select EXT (positions 1 and 2 OFF), it is synchronized to the external transmit clock from the data terminal equipment (DTE).
- If you select RCV (position 1 ON and position 2 OFF), the transmit clock is locked to the modem receive clock.

DSR Status (Switch Group S6, Positions 4 and 5)

You may select three DSR status modes by switch setting:

- DSR ON at all times (positions 4 and 5 OFF)
- DSR ON except in test pattern (positions 4 and 5 ON)
- DSR follows DTR (position 4 ON and position 5 OFF)

CTS Delay (Switch Group S7, Position 1)

In continuous carrier mode, CTS delay is 0 ms or 15 ms. For a 0 ms delay, set position 1 ON. For a 15 ms delay, set position 1 OFF.

In the controlled carrier mode, the delay is dependent on the length of the training sequence and is not dependent on this switch setting.

Constant or Controlled Carrier in Transmitter (Switch Group S7, Position 2)

Constant carrier operation (CNT, position 2 OFF) is designated for the modem in a point-to-point system or the central modem in a multipoint system. For a remote modem in a multipoint system, the carrier should be controlled by the RTS on the DTE interface. Select the controlled carrier mode (CNL) by setting position 2 ON.

Automatic Retrain (Switch Group S7, Position 3)

When you select Retrain Enabled (position 3 OFF), two conditions will initiate automatic retrain:

- Either modem in a point-to-point link having a bit error rate worse than approximately 10^{-4} for three seconds.
- The remote modem in a multipoint system having a bit error rate worse than approximately 10^{-4} for three seconds.

The central-site modem will configure a remote modem at power-up of a multipoint system. The retrain functions, described above, will result in a momentary loss of customer data. Retrain Enabled should always be used.

When Retrain Disabled is selected, the modem(s) will try to train on data. This configuration is suggested if the system is under complete DTE control.

T-Type Equalizer (Switch Group S7, Position 4)

You may select a T-type or T/2-type equalizer by switch setting. It is suggested that T/2 (position 4 OFF) be used at all times, except in 2-wire operation with severe echo; in which case, set position 4 ON.

Constant or Switched Carrier in Receiver (Switch Group S7, Position 5)

You may select constant carrier or switched carrier mode for the receiver by switch setting. The constant setting (CST, position 5 OFF) is used in point-to-point applications. The switched carrier setting (SW, position 5 ON) is used if the incoming carrier signal is switched as in the central modem of a multipoint system.

Anti-Streaming (Switch Group S7, Position 6)

This function prevents a network from being tied up by a malfunctioning terminal. The transmitter of a remote modem in a multipoint network will be squelched if RTS from the terminal has been High for more than 30 seconds. Later, the transmitter will be reengaged when the source signal of RTS drops. You may select anti-streaming by switch setting:

- Anti-streaming enabled — position 6 OFF
- Anti-streaming disabled — position 6 ON

Two-Wire or Four-Wire (Switch Group S7, Positions 7 and 8)

The normal operating mode for the Data Modem is 4-wire (position 7 ON and position 8 OFF).

The 2-wire mode (position 7 OFF and position 8 ON) is used for 2-wire leased line operation or operation over the dial network with appropriate connecting devices. Receiver input is squelched while RTS is ON and is resumed approximately 20 ms after RTS drops. The response to RTS is held back for approximately 20 ms after RTS and DCD drop. This delay period allows time for the echo to die out.

Transmit Level (Switch Group S8, Positions 1 through 4)

These switches control the output level of the data modem for domestic use over leased lines. Domestic level is 0 dBm. Consult your PTT for international requirements. The squelched level of transmitted output is below −60 dBm.

The settings for the transmit output level are as follows:

Transmit Attenuator (dBm)	Position/Setting 1	2	3	4
0	OFF	OFF	OFF	OFF*
-1	ON	OFF	OFF	OFF
-2	OFF	ON	OFF	OFF
-3	ON	ON	OFF	OFF
-4	OFF	OFF	ON	OFF
-5	ON	OFF	ON	OFF
-6	OFF	ON	ON	OFF
-7	ON	ON	ON	OFF
-8	OFF	OFF	OFF	ON
-9	ON	OFF	OFF	ON
-10	OFF	ON	OFF	ON
-11	ON	ON	OFF	ON
-12	OFF	OFF	ON	ON
-13	ON	OFF	ON	ON
-14	OFF	ON	ON	ON
-15	ON	ON	ON	ON

*Factory and recommended setting.

Data Carrier Detect (DCD) (Switch Group S8, Position 5)

The DCD turns on after the training sequence is over and prior to the user data. If no training sequence is detected, the DCD turns on in 5 to 15 ms for a received signal 3 dB above the turn-on threshold. If the received signal drops 5 dB below the turn-off threshold, the DCD turns off in 5 to 15 ms.

You may select two thresholds:

- –43 dBm, set position 5 OFF
- –26 dBm, set position 5 ON

There is a 2 dB minimum hysteresis between the turn-on and turn-off thresholds. For leased-line operation, use –26 dBm.

Line Loop Gain (Switch Group S8, Position 6)

You may select a unity gain or a 12 dB gain for the line loop. Domestic setting is 12 dBm. International setting is unity.

- Unity gain, set position 6 ON
- 12 dB gain, set position 6 OFF

Secondary In/Out (Switch Group S8, Positions 7 and 8)

Must be ON.

CONNECTING YOUR UNIT

There are three types of connections you must make to successfully install your unit. The first is the communications line interface. The second is the Data Terminal Equipment (DTE). The third is the power supply.

CAUTION

This unit incorporates components to provide secondary protection from lightning and other high voltage discharges and complies with Part 68.302 paragraphs d and e of the FCC regulations.

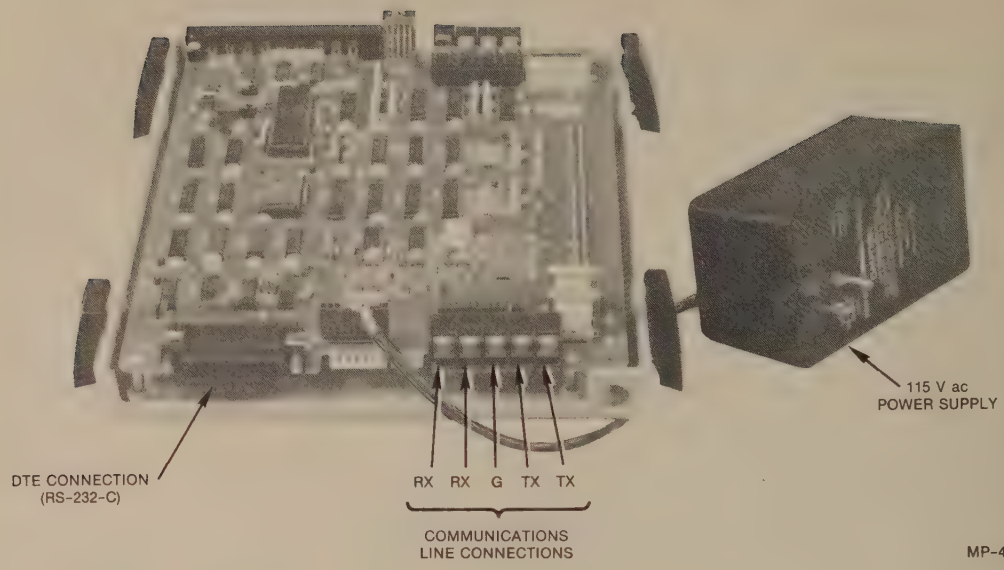


Figure 1-4. Cable Connection Locations

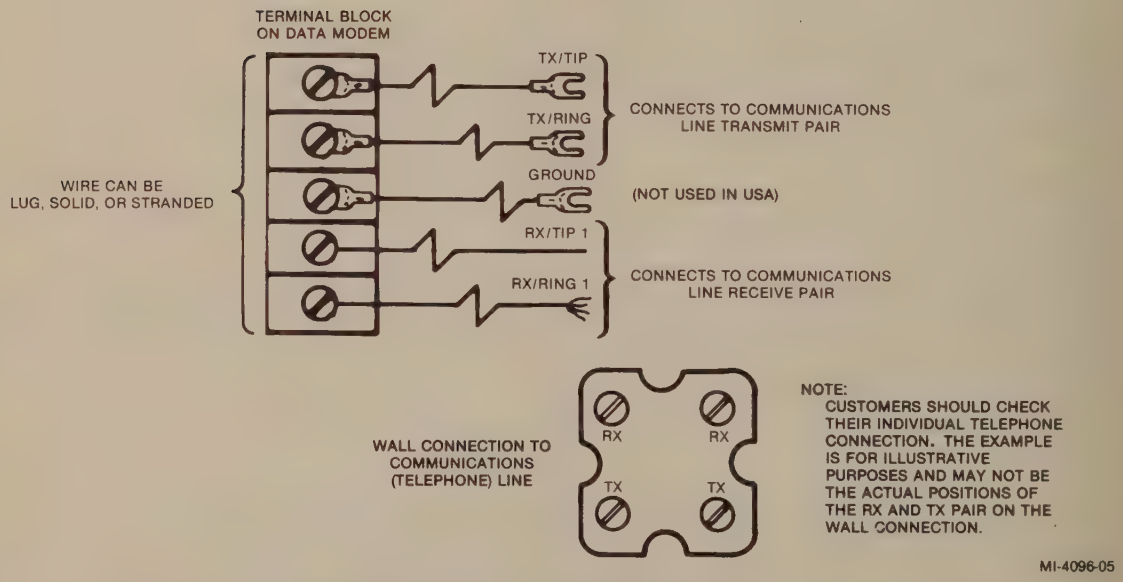


Figure 1-5. Terminal Block Connection to Communications Line

YOUR UNIT'S POWER SUPPLY

One of two different power supplies may be installed in your unit, depending on whether it is intended for 115 V ac (USA) or 230 V ac (export) operation.

There are no switches or adjustments on your power supply. It need only be connected to your unit and inserted into an ac power wall outlet. See figure 1-6. (The power supply shown is a USA unit.)

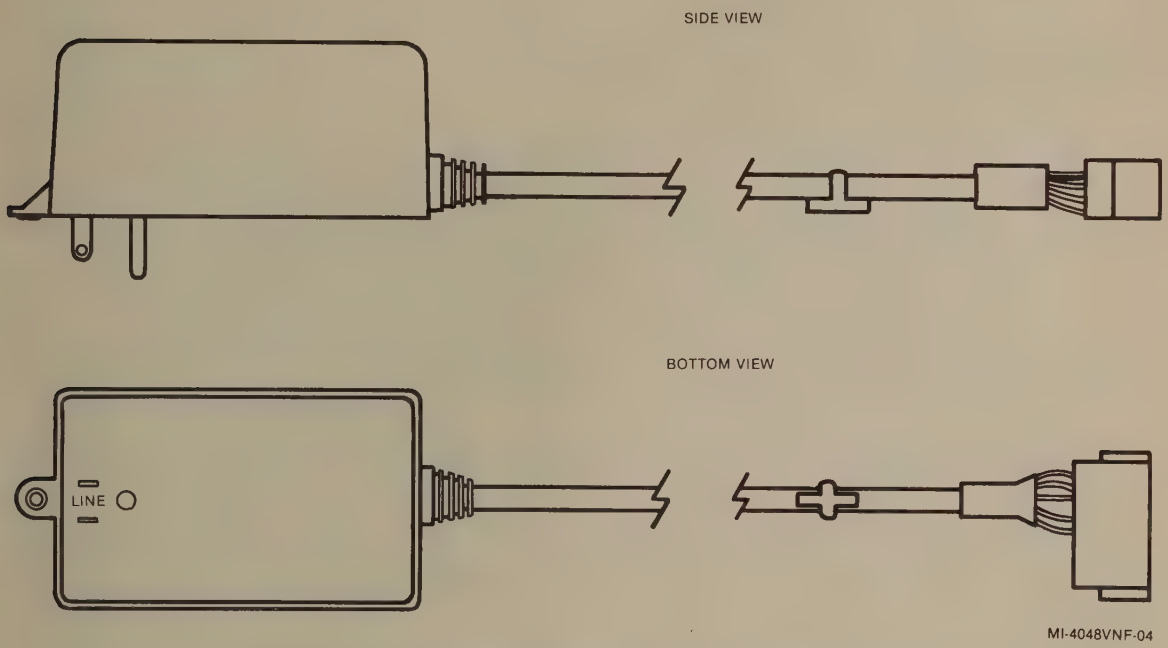


Figure 1-6. Cable Connection to Power Supply

APPLYING POWER TO YOUR UNIT AND CHECKING FOR PROPER OPERATION

Four-Wire, Point-to-Point Operation

First, plug in your DTE.

Second, connect communication line.

Then, plug in your power unit.

When the local unit is initially plugged in and communication is not yet established with the remote unit, the local LED display should be as follows:

NOTE

After power-up, your unit may take up to 20 seconds to initialize. During this time your modem unit is configuring its software and its operating speed. Also during this time, all elements of the seven-segment LED indicator will be on. If, after 20 seconds, the letters H-E-L-P FLASH sequentially on the indicator, your modem unit has been configured to an invalid condition. Before proceeding, please verify configuration data according to table 1-1.

RS — ON (received from DTE)
CS — ON (if RTS ON)
CD — OFF (until signal is received from remote modem)

Next, establish communication with the remote unit according to your regular operating procedures.

When communication has been established with the remote unit, the local and remote LED displays should be as follows:

RS — ON
CS — ON
CD — ON
TD — FLICKERING (data transmitted)
RD — FLICKERING (data received)
SQ — ON (indicating good data)

Four-Wire, Multipoint Operation

First, plug in your DTE.

Second, connect communication line.

Then, plug in your power unit.

When the central site unit is initially plugged in and communication is not yet established with the remote units, the local LED display should be as follows:

NOTE

After power-up, your unit may take up to 20 seconds to initialize. During this time your modem unit is configuring its software and its operating speed. Also during this time, all elements of the seven-segment LED indicator will be on. If, after 20 seconds, the letters H-E-L-P FLASH sequentially on the indicator, your modem unit has been configured to an invalid condition. Before proceeding, please verify configuration data according to table 1-2.

RS — ON (received from DTE)
CS — ON
CD — OFF (until signal is received from remote modem)

Next, establish communication with each remote modem, one at a time and in sequence according to your regular operating procedures.

When communication has been established with the remote modems, the central site LED display should be as follows:

RS — ON
CS — ON
CD — ON and OFF (alternating)
TD — FLICKERING (data transmitted)
RD — FLICKERING (data received)
SQ — ON and OFF (alternating)

The remote LED display should be as follows:

RS — ON and OFF (alternating)
CS — ON and OFF (alternating)
CD — ON
TD — FLICKERING (data transmitted)
RD — FLICKERING (data received)
SQ — ON (indicating good data)

Two-Wire Operation

First, plug in your DTE.

Second, connect communication line.

Then, plug in your power unit.

When the local modem is initially plugged in and communication is not yet established with the remote modem, the local LED display should be as follows:

NOTE

After power-up, your unit may take up to 20 seconds to initialize. During this time your modem unit is configuring its software and its operating speed. Also during this time, all elements of the seven-segment LED indicator will be on. If, after 20 seconds, the letters H-E-L-P FLASH sequentially on the indicator, your modem unit has been configured to an invalid condition. Before proceeding, please verify configuration data according to table 1-2.

RS — ON and OFF (alternating)
CS — ON and OFF (alternating)
CD — OFF (until signal is received from remote modem)

Next, establish communication with the remote modem according to your regular operating procedures.

When communication has been established with the remote modem, the local display should be as follows:

RS — ON and OFF (alternating)
CS — ON and OFF (alternating)
CD — ON and OFF (alternating)
TD — FLICKERING (data transmitted)
RD — FLICKERING (data received)
SQ — ON and OFF (alternating)

The remote LED display should be as follows:

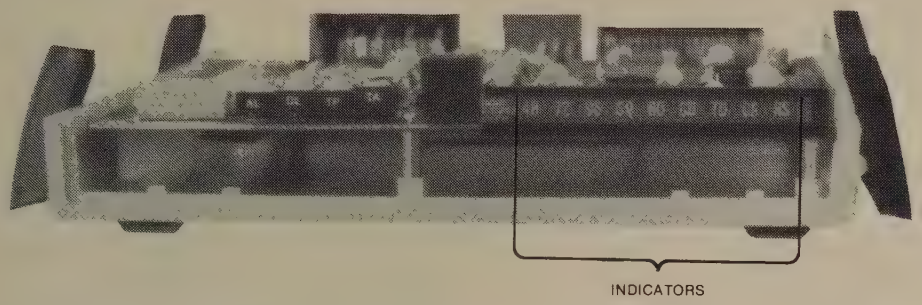
RS — ON and OFF (alternating)
CS — ON and OFF (alternating)
CD — ON and OFF (alternating)
TD — FLICKERING (data transmitted)
RD — FLICKERING (data received)
SQ — ON and OFF (alternating)

SECTION 2

TESTING YOUR MODEM

READING YOUR UNIT'S DISPLAY

The illustration below shows the location of the display LEDs.



MP-4096-06.1

Figure 2-1. Display Location

The table below provides the general interpretation of the LED display.

Table 2-1. Display Interpretation

Display Indicator	ON	OFF	FLASHING
RS Request-To-Send	Request-To-Send	Request-To-Send	DTE is raising and lowering RTS as in remote polling.
CS Clear-To-Send	Clear-To-Send	Clear-To-Send	Modem is responding to the raising and lowering of RTS as in remote site polling.
TD Transmitted Data	Transmitted Space	Transmitted Mark	DTE is presenting combinations of Mark (1) and Space (0) data as in normal data flow.
CD Carrier Detect	Data carrier signal is present.	No data carrier signal is present.	Modem is responding to the receipt of carrier as in the local site of multipoint.
RD Received Data	Received Space	Received Mark **RD** is held in Mark if carrier is lost.	In Test Pattern mode, indicates errors received. In Normal mode, modem is passing combinations of Mark and Space data as originated by DTE at remote site.
SQ Signal Quality	When bit error rate is better than 1×10^{-4}.	When bit error rate is worse than than 1×10^{-4}, or carrier is not present.	• • •
96 9600 bps	Data rate is 9600 bps.	Data rate is not 9600 bps.	• • •
72 7200 bps	Data rate is 7200 bps.	Data rate is not 7200 bps.	• • •
48 4800 bps	Data rate is 4800 bps.	Data rate is not 4800 bps.	• • •
AD Test Address	TA button was pressed or unit is in test mode.	TA button not pressed; unit is not in test mode.	For fault indication, see page 2-3.

DESCRIPTION OF DIAGNOSTIC SWITCH FUNCTIONS

Four pushbutton switches provide the capability of testing the modem, and 10 LED indicators display the various functions and addresses of the modem. They are located on the front of the modem as shown in figure 2-2.

The *Analog Loopback Switch* (AL) is used to perform local or remote analog loopback testing.

The *Digital Loopback Switch* (DL) is used to perform local or remote digital loopback testing.

The *Test Pattern Switch* (TP) is used to enable the local test pattern generator and detector.

The *Test Address Switch* (TA) is used to step through addresses 0 to F (hex) plus U, H, and L designators. The addresses are displayed on the **AD** indicator. The TA switch is disabled at the remote modem(s) of a multipoint system.

Test Address Switch (TA)

The TA switch is used to select modems for checking. This switch works in conjunction with the test address indicator, **AD**. The **AD** is a seven-segment light-emitting diode (LED) which incrementally displays address selections at a rate of 0.5 seconds per increment. When the TA switch is pressed and held down, the **AD** indicator will sequence through three addressing selections (U, H, L) in a point-to-point configuration. In a multipoint configuration, it will sequence through 18 addressing selections (H, L, and 0 through F hex). The selections are as follows:

U — Universal*	This selects the remote modem in the point-to-point mode.
H — Home	This selects the local modem in a multipoint system or either modem of a point-to-point system.
L — Load	This selection permits the local modem to downline load all the existing configuration functions to the remote modem(s).
0-F*	These represent the 16 hexadecimal addresses that can be assigned to individual remote modems. Choosing one of these addresses selects a modem for testing.

*When a remote test is commanded, the modem initiating the command should display the selected address after the test has been initiated. If the displayed address begins to FLASH, it is indicating that the remote modem has not responded to the command after three tries. Suspect telephone facilities or the remote modem as the source of this failure. To clear the FLASHING display, hold the TA switch down until the next address is displayed.

Configuration Function

The remote modem(s) can be configured to a mode compatible with that of the central modem. Set the **AD** indicator to the L address, then press the TA switch three times. This will downline load the reconfiguration command to the remote unit(s). Note that if you change the fallback data rate (switch group S5, position 4), you must use the L function to command the downline load.

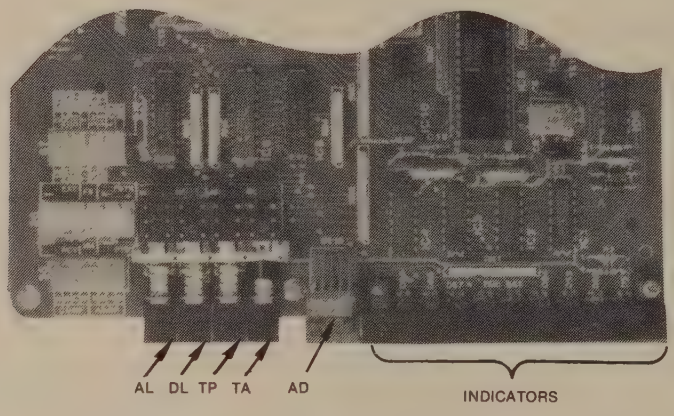


Figure 2-2. Location of Test Switches

DIAGNOSTICS

Your data modem is equipped with diagnostics which allow you to determine the location of a failure in your communications link. Pushbutton switches perform the test functions described in the following paragraphs.

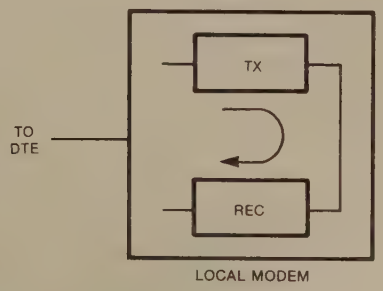
NOTE

In a point-to-point system, either modem may remotely command the other unit.

Analog Loopback Test Mode

You will use the AL switch to place a selected modem in the analog loopback mode.

If you select H via the TA switch and press the AL switch, the local modem will be commanded into the analog loopback mode. See figure 2-3.



MI-4096-08

Figure 2-3. Local Modem Analog Loopback Data Flow

If you select a remote modem address (0 to F multipoint, or U point-to-point) via the TA switch and press the AL switch, that modem will be commanded to loop the telephone line back to the local modem. See figure 2-4.

Figure 2-4. Remote Modem Analog Loopback and Line Data Flow

If you press the AL switch at a remote modem, only that modem will go into the analog loopback mode. See figure 2-5.

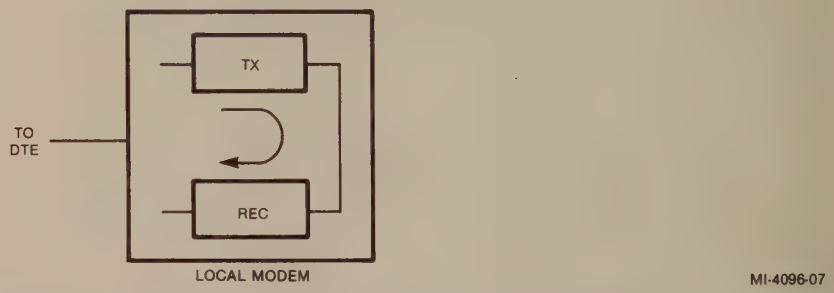
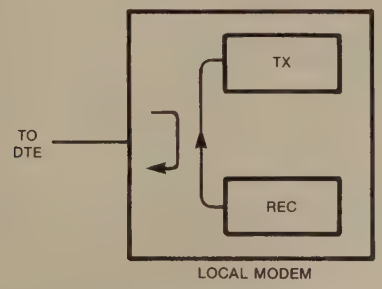


Figure 2-5. Remote Modem Analog Loopback Data Flow

Digital Loopback Test Mode

You will use the DL switch to place a selected modem in the digital loopback mode.

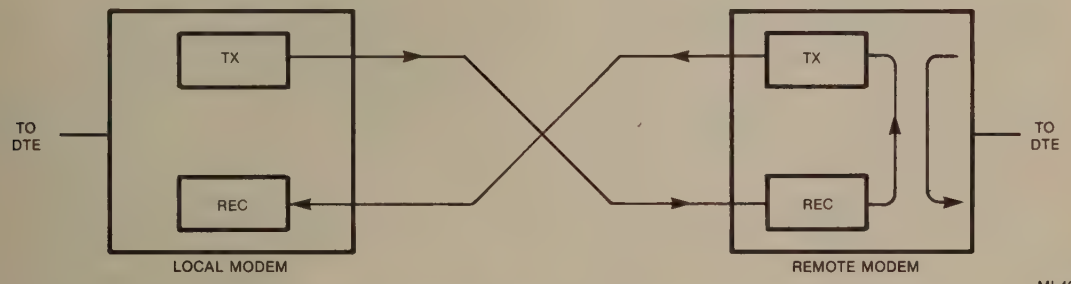
If you select H via the TA switch and press the DL switch, the local modem will be commanded to loop the DTE as shown in figure 2-6.



MI-4096-03

Figure 2-6. Local Modem Digital Loopback Data Flow

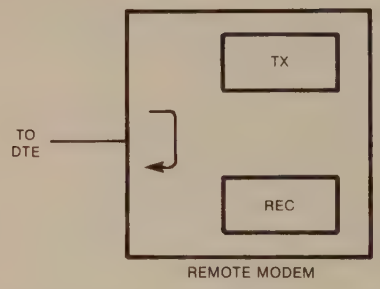
If you select a remote modem address (0 to F multipoint, or U point-to-point) via the TA switch and press the DL switch, the selected modem will be commanded to loop the digital interface back to the local modem. See figure 2-7.



MI-4096-04

Figure 2-7. Remote Modem Digital Loopback and Line Data Flow

If you press the DL switch at a remote modem, only that modem will go into the digital loopback mode. See figure 2-8.



MI-4096-12

Figure 2-8. Remote Modem Digital Loopback Data Flow

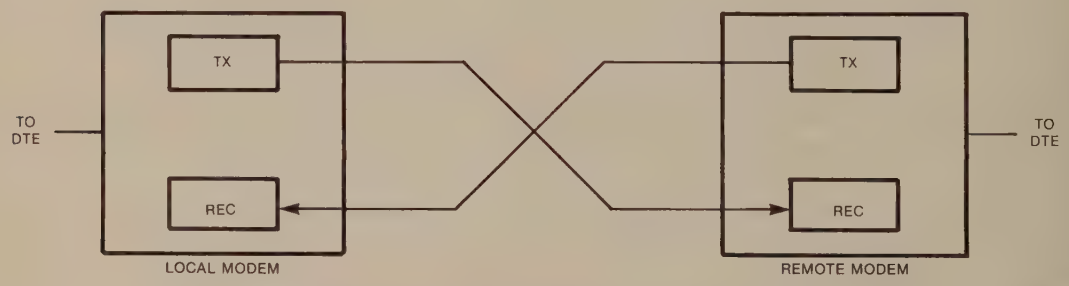
Test Pattern Test Mode

The test pattern may be used once the analog or the digital loopback mode has been selected. This test mode is used to detect the presence of errors on the communications link. (See figure 2-9.)

The following test aids in determining which side of the telephone line is defective. This test requires operator intervention at the remote modem.

Press the TP switch at local modem.
Press the TP switch at remote modem.
Observe the **RD** indicator.

If the **RD** indicator stays ON or continues FLASHING on a modem, this indicates a fault in the receive data path for that modem.



MI-4096-09

Figure 2-9. Full-Duplex Line Data Flow

Sample Test Procedure

The following sample depicts a normal test procedure used to verify the condition of the communications link from the local modem to the selected remote modem (e.g., address 1).

a. Set the TA switch to H.
Press the AL switch.
Press the TP switch.
Observe the **RD** indicator.

If the **RD** indicator stays ON or continues FLASHING, then the local modem is defective. If the **RD** indicator does not flash, the local modem is operative.

Release all switches.

b. Set the TA switch to 1.
Press the AL switch.
Press the TP switch.
Observe the **RD** indicator.

If the **RD** indicator stays ON or continues FLASHING, suspect telephone line trouble.

NOTE

The remote AL switch connects two voice frequency lines (TX, RX) in series. It is possible that the combined lengths of the circuit will make that circuit unable to meet the line requirements for a 3002 circuit. If the local modem will not train, try using the fallback speed. If the modem still will not train, presume the trouble is in the phone line. If the modem does train, revert to normal speed and continue testing.

Release all switches.

c. Set the TA switch to 1.
Press the DL switch.
Press the TP switch.
Observe the **RD** indicator.

If the **RD** indicator stays ON or continues FLASHING, suspect a defective remote modem.

NOTE

Occasional errors over a several minute test period should not be a cause for alarm.

Release all switches.

WARRANTY

MICOM warrants that the equipment delivered shall be free from defective material and workmanship for a period of 1 year from the date of delivery of equipment when given normal, proper and intended usage, and agrees to repair or replace, without cost, any part manufactured by MICOM provided that:

(a) MICOM is promptly notified upon discovery that the equipment is defective;

(b) The equipment is returned prepaid to the MICOM plant from which the equipment was shipped; and

(c) MICOM's examination of the equipment shall disclose that any defect was not caused by accident, misuse, neglect, alteration, improper installation, unauthorized repair or improper testing.

MICOM may, in its sole discretion, elect to repair or replace the equipment, in which event MICOM shall have a reasonable time to make repairs or to replace the equipment. MICOM will return the equipment freight prepaid.

THE PROVISIONS OF THIS WARRANTY ARE IN LIEU OF ANY OTHER WARRANTY, WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL (INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), AND MICOM'S LIABILITY ARISING OUT OF THE MANUFACTURE, SALE, OR SUPPLYING OF THE EQUIPMENT OR ITS USE, WHETHER BASED UPON WARRANTY, CONTRACT, NEGLIGENCE, PRODUCTS LIABILITY OR OTHERWISE, SHALL NOT EXCEED THE ORIGINAL COST TO THE BUYER OF THE EQUIPMENT. IN NO EVENT SHALL MICOM BE LIABLE TO THE BUYER OR ANY OTHER PERSON OR ENTITY FOR UNINTENDED OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS OR USE DAMAGES) ARISING OUT OF THE MANUFACTURE, SALE OR SUPPLYING OF THE EQUIPMENT.

MICOM warrants all repairs or upgrades performed at its factory location or performed by MICOM Customer Service for a period of 90 days after completion.

HOW TO GET YOUR EQUIPMENT FIXED BY MICOM CUSTOMER SERVICE

MICOM's Customer Service offers a wide range of support functions, including complete factory repair for both in-warranty and out-of-warranty equipment.

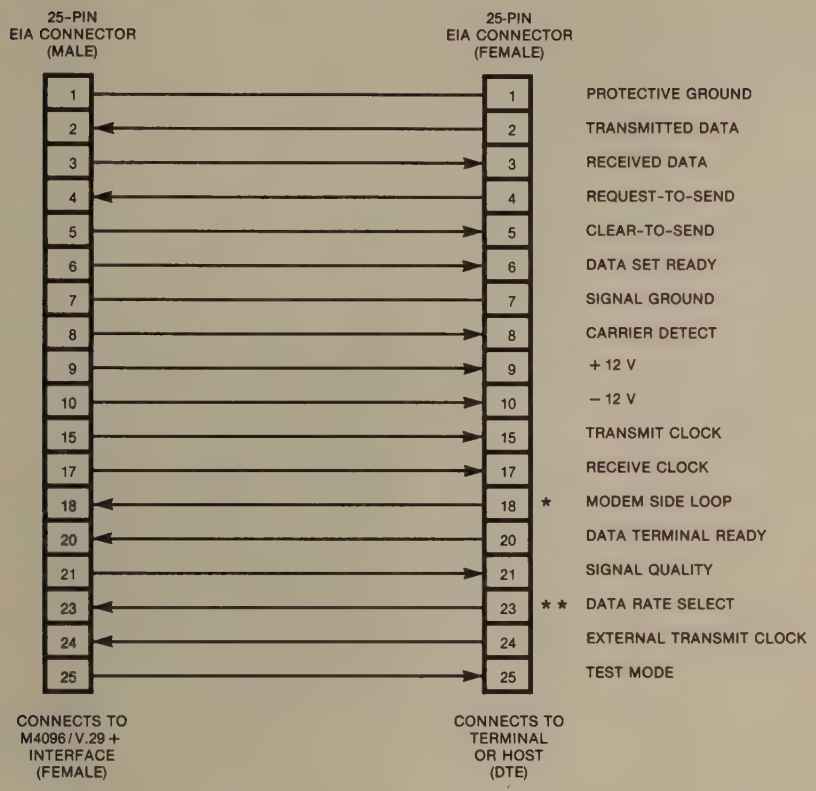
Before returning any equipment, please contact MICOM Customer Service or your local Distributor. In the U.S.A. and Canada, call MICOM's Customer Service Hotline (800) 833-3282. In all other countries, contact your local MICOM Distributor.

A Customer Service engineer will answer warranty-related questions, discuss your specific equipment problems, and — when necessary — give you shipping instructions for returning equipment to MICOM for repair. To return a product for service or repair, you *must* obtain a Return Authorization number from MICOM Customer Service.

Shipping charges must be prepaid.

APPENDIX A

CABLE WIRING



* LOCAL ANALOG LOOPBACK MAY BE INITIATED FROM THE TERMINAL BY APPLYING A SPACE CONDITION ON PIN 18. A MARK CONDITION WILL RETURN THE MODEM TO NORMAL OPERATION.

** ALL MODEMS MAY BE SHIFTED TO A FALLBACK SPEED BY APPLYING A SPACE CONDITION ON PIN 23 OF THE CENTRAL MODEM IN MULTIPOINT OR EITHER MODEM IN POINT-TO-POINT. A MARK CONDITION WILL RETURN ALL MODEMS TO NORMAL SPEED.

NOTE:
THIS CABLE IS NORMALLY PROVIDED BY THE DTE MANUFACTURER.

MI-4096-11

Figure A-1. Typical Terminal Cable Pin Assignments

APPENDIX B

TECHNICAL SPECIFICATIONS

Antistreaming:

If Request-To-Send (RTS) at the remote modem is held high for more than 30 seconds, the modem transmitter will be muted until the cause of RTS high is removed. This feature eliminates the catastrophic results of a streaming terminal or modem on a multipoint circuit.

Clear-To-Send Delay:

0 and 15 ms are user-selectable for 4-wire, point-to-point constant carrier operation; 9, 50, 75, and 100 ms are used in multipoint and 2-wire, half-duplex operation; 100 ms is used in 2-wire, half-duplex operation.

9 ms is used in speedshift mode. After a 9 ms RTS/CTS delay, the modem sends data at 2400 bps. After an additional 26 ms, the modem shifts to 4800 bps.

Equalization:

Automatic adaptive equalizer
Equalization time:

9 ms	"speedshift" multipoint
50 ms	V.27 bis specification
75 ms	9600 bps multipoint
100 ms	9600 bps multipoint
253 ms	V.29 specification (4-wire, point-to-point)

External and Internal Transmit Clock Frequency:

9600, 7200, and 4800 Hz ±0.01%

Indicators:

CD	Carrier Detect
SQ	Signal Quality
RS	Request-To-Send
CS	Clear-To-Send
TD	Transmitted Data
RD	Received Data
96	Transmission Speed
72	Transmission Speed
48	Transmission Speed
AD	Address Display (7-segment LED)

Line Interface:

600 ohms impedance, transformer coupled, and transient protected

Line Requirement:

2- or 4-wire leased, point-to-point or multipoint unconditioned. In the USA and Canada, AT&T Type 3002 basic channel or equivalent. Internationally, Type M1020 or M1040 leased line.

Loopback Tests:	Digital Loopback turns the received data at the modem's digital (terminal) interface back to the line; and loops the terminal's transmitted data back to the terminal. Analog Loopback turns the transmitted data at the analog (telephone line) interface back to the terminal; or loops data received over the line back to the remote terminal. Test switch generates a pseudo-random data pattern and activates a pattern detector for use with loopback tests.
Modem Type:	MOS / LSI synchronous Compatible with CCITT V.29
Modulation:	9600 / V.29: 8-phase, 4-amplitude quadrature modulation (QAM); 2400 bps 7200/V.29: 8-phase, two-amplitude QAM; 2400 bps 4800/V.29: 4-phase, single-amplitude QAM; 2400 bps 4800/V.27: 8-phase, 1600 bps 4800 Speedshift: 8-phase, four-amplitude QAM; 1200 bps
Receiver Sensitivity:	-26 dBm or -43 dBm, selectable
Terminal Interface:	EIA RS-232-C (CCITT V.24/V.28) serial synchronous, full or half-duplex. Female 25-pin connector. Internal or external clock.
Transmission Speed:	9600 bps with fallback to 7200 bps or 4800 bps
Transmitter Output Level:	0 to -15 dBm, selectable in 1 dB steps

APPENDIX C

PHYSICAL SPECIFICATIONS

Operating Environment: 32-114°F (0-45°C), 0-95% relative humidity

Power:
USA — 115 ± 10% V ac, 47-63 Hz, 15 watts;
Export — 230 ± 10% V ac, 47-63 Hz, 15 watts

Size:
Standalone Unit

8¾ inches (22.2 cm) wide
2¼ inches (5.7 cm) high
11½ inches (29.2 cm) deep
Weight: 3 pounds (1.4 kg)

APPENDIX D

MODEM ADDRESS RECORD

Modem Address	*Field Definition*
0	Name _____
	Address _____
	City _____
	State _____
	Tel. No. _____
	Person to Contact _____
1	Name _____
	Address _____
	City _____
	State _____
	Tel. No. _____
	Person to Contact _____
2	Name _____
	Address _____
	City _____
	State _____
	Tel. No. _____
	Person to Contact _____

Modem Address	*Field Definition*	
3	Name	_____
	Address	_____
	City	_____
	State	_____
	Tel. No.	_____
	Person to Contact	_____
4	Name	_____
	Address	_____
	City	_____
	State	_____
	Tel. No.	_____
	Person to Contact	_____
5	Name	_____
	Address	_____
	City	_____
	State	_____
	Tel. No.	_____
	Person to Contact	_____

Modem Address	*Field Definition*
6	Name _____
	Address _____
	City _____
	State _____
	Tel. No. _____
	Person to Contact _____
7	Name _____
	Address _____
	City _____
	State _____
	Tel. No. _____
	Person to Contact _____
8	Name _____
	Address _____
	City _____
	State _____
	Tel. No. _____
	Person to Contact _____

Modem Address	*Field Definition*
9	Name _____
	Address _____
	City _____
	State _____
	Tel. No. _____
	Person to Contact _____
A	Name _____
	Address _____
	City _____
	State _____
	Tel. No. _____
	Person to Contact _____
B	Name _____
	Address _____
	City _____
	State _____
	Tel. No. _____
	Person to Contact _____

Modem Address	*Field Definition*
C	Name _____
	Address _____
	City _____
	State _____
	Tel. No. _____
	Person to Contact _____
D	Name _____
	Address _____
	City _____
	State _____
	Tel. No. _____
	Person to Contact _____
E	Name _____
	Address _____
	City _____
	State _____
	Tel. No. _____
	Person to Contact _____

Modem Address	*Field Definition*
F	Name _____
	Address _____
	City _____
	State _____
	Tel. No. _____
	Person to Contact _____

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NOTES

PUBLICATION CHANGE REQUEST

A message to our readers: we try to make our product manuals as accurate, complete, and easy to use as possible. If you have an improvement to suggest (or find an error in this manual), **LET US KNOW:**

a. Fill in the four sections below.
b. Staple any marked-up pages to this side of request form.
c. Fold entire package in thirds—so that the MICOM address shows.
d. Staple package shut.
e. Fill in your return address in the space provided on both sides of this request form.
f. Drop in mail box.

MANUAL IDENTIFICATION (take from the title page of your manual)

EQUIPMENT COVERED (take model number from silver tag on unit) _____

DATE OF MANUAL _____ STOCK NUMBER _____

PROBLEM *

_____

_____

_____

_____

_____

SUGGESTED SOLUTION *

_____

_____

_____

_____

_____

READER IDENTIFICATION

NAME AND TITLE _____ DATE _____

ADDRESS _____ TELEPHONE ( ) _____

_____

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* The best way to help us identify and correct the problem you discovered is to attach marked-up copies of the affected pages.

Thank you for taking the time and making the effort to fill in this request. We will review and respond to your request by return mail.

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United Kingdom
MICOM-Borer Ltd.
Bel Court, 15 Cradock Road
Reading, Berkshire RG20JT
Telephone (0734) 886801
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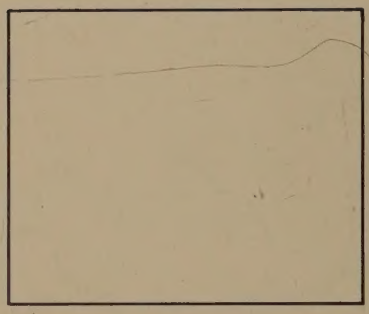

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